

# USGS Chesapeake Bay Watershed Accomplishments for Fiscal Year 2017

The U.S. Geological Survey (USGS) has the critical role of providing scientific information to improve the understanding and management of the Nation's largest estuary -- the Chesapeake Bay ecosystem. The USGS works with Federal, State, and academic science partners to provide monitoring, research, and communication of results to enhance ecosystem management for both the Chesapeake and other critical ecosystems. The U.S. Department of the Interior (DOI), through the USGS, the U.S. Fish and Wildlife Service (USFWS), and the National Park Service (NPS), is providing leadership, expertise, and resources to carry out the Chesapeake Watershed Agreement (2014--2025), which was signed by the Chesapeake Bay Program (CBP), and includes the Federal Government, six states and the District of Columbia. The DOI has a leadership role for carrying out 7 of the 10 goals described in the Agreement. Major USGS Chesapeake Bay accomplishments for 2017 are described below. The efforts are supported by multiple USGS Mission Areas (MAs) and partners.

## [Groundwater is helping sustain stream temperatures for cold-water fisheries](#)

The majority of streams in the Chesapeake Bay region are warming, and this warming will affect species distributions, as well as suitable habitat for Brook Trout and other cold-water species. The USGS has been working with the NPS and other partners to help understand the effects of climate change and stream temperatures on Brook Trout. Recently completed studies evaluated where groundwater can help sustain cooler stream temperatures needed by Brook Trout during the warm summer months. Another study demonstrated the detrimental effects of non-native species on Brook Trout at higher stream temperatures. The NPS is applying the results to help manage areas of Shenandoah National Park and Catoctin National Park. The USGS will be summarizing results from several Brook Trout studies to help inform restoration and protection of streams throughout the Chesapeake and the Northeast. *Supported by the USGS Ecosystems and Water MAs*

## [The potential effects of unconventional oil and gas development on fish and streams](#)

The USGS completed several studies to understand the potential effects of unconventional oil and gas (UOG) development on Brook Trout and stream habitat. Results of this work have produced a new high-resolution Brook Trout occupancy model and a fine-scaled risk assessment that captures the effects of infrastructure, water withdrawals, and probabilistic spills for headwater streams. This approach incorporates the cumulative effects of UOG development on streams and can be used to identify catchments and reaches at risk by existing stressors or future development. These at-risk areas can be incorporated into wider scale assessments of conservation and restoration goals for the Chesapeake Bay watershed. *Supported by the USGS Ecosystems MA.*

## [The combined effects of contaminants and other stressors on fish](#)

The USGS continues studies on the sources, exposure, and effects of endocrine-disrupting compounds (EDCs), and other stressors on fish, so that partners will have improved information to reduce their effects on fisheries. During 2017, USGS scientists compiled, organized, and released data collected from several long-term studies. This long-term data will be the foundation for a retrospective analysis of the relations between fish health, land use, and EDCs in 2018. During 2018, USGS will work to summarize the findings associated with ongoing efforts through a series of

scientific publications, data releases, and presentations to stakeholder groups. *Supported by the USGS Environmental Health and Ecosystems MAs.*

### Increasing habitat for migratory waterbirds

The USGS is supporting partners with science to restore coastal wetlands, which provide habitat and food for almost 1 million migratory waterfowl that winter in the Bay region. The USGS is completing development of “bioenergetics models” to better understand the food requirements of Black Ducks, a key indicator species. The models focus on several USFWS Refuges, so their managers can develop options for habitat restoration and protection that increase habitat and food availability for Black Ducks. During 2018, the USGS will add the final variables to the models to incorporate the potential effects of sea-level rise and land development. In 2017, data collection at several refuges was conducted to support analysis needed for the sea-level rise component that will be incorporated into a wetland habitat layer that will be foundational to the overall project. *Supported by the USGS Ecosystems and Land Resources MAs.*

### Explaining water-quality trends to inform nutrient and sediment management

The USGS leads monitoring of nutrients and sediment in the nontidal portions of the Bay watershed and is applying innovative approaches to explain water-quality patterns throughout the entire watershed. In support of the 2017 Midpoint Assessment, the USGS is contributing a number of water-quality synthesis activities to explain patterns in water quality and inform watershed management. For each synthesis activity, USGS is summarizing available research for each topic and assembling this understanding into a management-relevant context to assist resource managers as they develop future Watershed Implementation Plans (WIPs). USGS is working to contribute synthesis materials on the following topics:

- Explaining long-term changes in nutrient and sediment inputs to Chesapeake Bay.
- Describing the influence of Susquehanna Reservoirs on loads and water quality in the Bay and management implications under the Total Maximum Daily Load (TMDL).
- Explaining yields and trends of nitrogen and phosphorus throughout the Chesapeake watershed.
- Synthesizing advances in understanding sediment sources, transport, and delivery processes relevant to Chesapeake restoration efforts.

*Supported by the USGS Water and Ecosystems MAs.*

### The effects of the Susquehanna Reservoirs on sediment and nutrients loads to the Bay

The USGS, working with several partners, completed an initial synthesis on the increasing amount of sediment and phosphorus being delivered to the Bay due to the loss of storage capacity in the reservoirs. The USGS also helped lead a CBP Scientific and Technical Advisory Committee (STAC) workshop to summarize the science and additional research needed to further understand the issue. The findings are being used by water-quality managers to consider options to mitigate the effects of the Susquehanna reservoirs. *Supported by the USGS Water and Ecosystems MAs.*

### The relation between water-quality change and management practices in urban and agricultural settings

The USGS released a number of studies that evaluated the temporal and spatial patterns in nutrients and sediment in small agricultural and urban watersheds, with extensive Best Management Practice (BMP) implementation or restoration activities. One study explored sources, sinks, and transport patterns for nutrients and sediment across a range of agricultural basins; by improving the

understanding of these processes, watershed managers can better design management plans to improve water quality and downstream conditions. Another study modeled the watershed-scale impacts of urban BMP implementation and found improved nutrient and sediment removal from low impact development when compared to traditional stormwater management. The USGS also assessed differences in flow and nutrient and sediment transport between centralized and distributed stormwater control measures in small urban watersheds, and found distributed stormwater control reduced runoff and sediment loads during small rain events, but less during large events, when peak discharge likely leads to substantial bank erosion. These studies allowed managers to better assess the effects of practices to reduce nutrient and sediment transport. *Supported by the USGS Water, Land Resources, and Ecosystems MAs.*

### USGS coordinates researchers on syntheses of estuarine conditions

Five teams of researchers including Federal, State, and academic partners have been formed to address key topics of estuarine change over the past several decades of coordinated restoration. These teams have been formed under USGS leadership, with support from USEPA, and are independently producing reports that will serve to improve management strategies. Three decades of monitoring in the Bay and its tributaries has enabled the mapping of water-quality change in response to watershed restoration activities, climatic variation, and, biological change. The key topics include:

- Developing and applying new techniques to evaluate trends in tidal waters.
- Estuarine water quality and dissolved oxygen responses to changes in nutrient inputs.
- Developing an integrated understanding of drivers of changes in water clarity in different settings.
- Factors controlling the distribution and abundance of submerged aquatic vegetation (SAV).
- Linking watershed and estuarine changes in the Potomac River.

*Supported by the USGS Water and Ecosystems MAs.*

### Forecasting conditions in the Chesapeake Bay

Every year a team of scientists from NOAA, University of MD, and USGS utilize the most recent streamflow and nutrient monitoring data from the Susquehanna and Potomac Rivers to predict the Bay's hypoxic (low-oxygen) and anoxic (oxygen-free) zones. These conditions occur in late summer, and are largely driven by nutrients delivered from the watershed in the winter and spring. USGS monitoring programs provide the basis for these predictions. The forecasts provide resource managers valuable information for fisheries management decisions and serve as a clear public reminder that conditions in the Bay are driven by pollution in the watershed. In addition, the forecasting process provides a mechanism for scientists to refine their understanding of the connection between the Bay and the watershed. *Supported by the USGS Water and Ecosystems MAs.*

### USGS leads refinement of Chesapeake Watershed Partnership model

The USGS led, with support from USEPA, a collaborative team of Federal and academic researchers to build, test, and calibrate the CBP Phase 6 Watershed Model, which is used for decision support to improve water-quality conditions in the Chesapeake Bay TMDL. The main themes for the development were a multiple model approach; the incorporation of better data; and understandability of the modeling system by the management community. USGS products were used extensively throughout the development of the Phase 6 model, including results from USGS "SPARROW" modeling, measurements from the Chesapeake Floodplain Network, land-cover characterization,

groundwater modeling, fine-scale sediment modeling, observed water-quality data, and estimates of nutrient and sediment loads at monitoring sites. *Supported by the USGS Water, Land Resources, and Ecosystems MAs.*

### **USGS expands data collection to improve land classifications**

Agencies and resource managers are working together to collect higher resolution land-cover information to focus restoration practices. The USGS supported the Chesapeake Conservancy to develop more current, higher-resolution information for the Bay watershed. Several areas were identified that needed light detection and ranging (LIDAR) to better define elevation changes that affect the movement of nutrients and sediment. The USGS partnered with Natural Resources Conservation Service (NRCS), through the National Map: 3-D Elevation Program (3DEP), to collect over 6,500 square miles of Quality Level 2 LIDAR data for 13 counties in the Susquehanna basin. The information will help inform NRCS to implement conservation practices and enhance the Chesapeake Conservancy effort to improve stream network information. *Supported by the USGS Core Science Systems and Land Resources MAs.*

### **Improving land-use information for conservation and restoration decisions**

The USGS, working with CBP partners, completed a new land-use classification for the 100,000-square-mile area, including the drainage basin and adjacent counties within six States and the District of Columbia. The improved land-use data are needed to revise the CBP Watershed Model that is used for water-quality decision making. The USGS also enhanced the Chesapeake Bay Land Change Model that relies on historical information combined with county-level population and employment forecasts to provide scenarios of future development in the Bay watershed. The forecasts will be used by the USGS, NPS, and non-governmental organizations to assess the vulnerability of healthy watersheds and wildlife habitats and inform land conservation efforts, including those funded by the DOI Land and Water Conservation Fund. *Supported by the USGS Land Resources and Ecosystems MAs.*

### **Climate variability affecting streamflow**

As one of the principal drivers of environmental change in the Chesapeake watershed, the USGS continues to address the potential effects of climate variability on environmental conditions. USGS found that long-term trends in precipitation and riverine discharge indicate that the Chesapeake Bay watershed is getting wetter, but streamflows are not necessarily becoming more extreme. Trends in precipitation and discharge have increased spatially from the southern portion of the watershed to the northern portion over the 88-year period of record that was analyzed. Results of this study have implications for the mode of transport of pollutants to the Bay, as well as implications for achieving jurisdiction nutrient and sediment reduction goals by the 2025 endpoint. *Supported by the USGS Ecosystems and Water MAs.*

### **Rapidly providing science to Chesapeake Bay resource managers**

USGS has developed a new mechanism to increase the interaction between scientists and resource managers within the Chesapeake Bay partnership. This new team effectively integrates recent science into time-sensitive decision processes and focuses scientists around management-relevant topics. The CBP Integrated Trends Analysis Team (ITAT) is a science-focused group chaired by the USGS and the University of Maryland. ITAT's Jurisdictional Team provides a monthly forum to

discuss ongoing studies and their implications with water-quality managers. *Supported by the USGS Ecosystems MA.*

**For additional information**

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